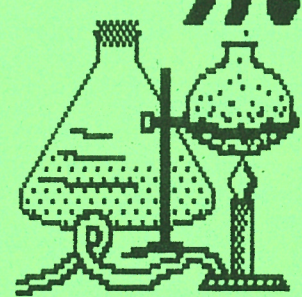


11/19/91

Advising Manual



Department of Chemistry



Mansfield University

FOREWORD

The information contained in this Advising Manual has been prepared for all persons with an interest in chemistry at Mansfield University. This Manual is intended as a guide to the programs and specific course requirements for the degree programs available in the Chemistry Department. At the time of its writing, all information contained in this Manual was checked and verified. However, due to the dynamic nature of academic institutions, changes may have been made to programs or requirements. Consult a current university catalog for the most up-to-date information. For more information about Mansfield University, please call Enrollment Services at (717)662-4243 or write to Beecher House, Mansfield University, Mansfield, PA 16933. For more information about the Chemistry Department, write us at Grant Science Center, Mansfield University or call the department secretary at (717)662-4540.

Greetings

The Chemistry Department at Mansfield University sends its greetings to you. Since you are reading this booklet, there is a possibility you will have some contact with us in the future. It is our sincere hope that whatever contact we might have will be educational and beneficial to your future career goals. We are a small, yet broad based; challenging, but caring department interested in your educational needs and aspirations. Chemistry surrounds us in all aspects of our lives and our careers. We would like to assist you in understanding its implications in your career goals. In whatever capacity, as a major, minor, or as part of your required curriculum, we are here to help you realize those goals to their fullest extent. The following pages describe the various aspects of the department, the institution, the various programs and unique opportunities available at Mansfield University. If you have questions concerning any portion of the program at Mansfield University, do not hesitate to contact us. We wish you well in your academic endeavors.

Chemistry and Career Options

Chemistry is the study of natural phenomena at the molecular level. Its study prepares the student for a variety of careers in business, academia, and government. The opportunities within these areas range from laboratory and technical work, to sales and customer service, all the way to management and supervisory positions. The graduate with a chemistry major or minor has acquired many of the skills that employers are seeking, especially in the areas of decision making and problem solving.

Our program prepares you for advanced studies in medicine, dentistry, optometry, patent law and related professions. Over half of our Bachelor of Science (B.S.) graduates continue with their chemistry studies in graduate school. Another option for B.S. chemistry majors would be to pursue a career in industry immediately upon graduation. Included in a list of these industries are positions in the food, pharmaceutical, petroleum, and chemical industries, involving both laboratory and non-laboratory work. In addition, Mansfield University offers a teacher certification program in chemistry, resulting in the Bachelor of Science in Education (B.S.E.). These persons also find themselves in great demand due to the national shortage of qualified high school science teachers.

In addition to the programs leading to the B.S. and B.S.E., chemistry provides service courses for several biology and physics programs and offers a minor. These offerings help the student in understanding science at the molecular level. You should seriously consider your interests and opportunities when choosing a major area of concentration. If we can be of any assistance in helping you decide, by providing additional information, please contact the Chemistry Department.

Chemistry Department

The Chemistry Department at Mansfield University is housed in Grant Science Center. Grant Science Center, expanded in 1971, is shared with the Departments of Biology and Physics and contains extensive modern laboratory facilities, including lab-lecture rooms, separate instrumental laboratories, a planetarium, dark room and stockroom.

In addition to the usual laboratory equipment and glassware, the department has a large assortment of instrumentation available for student use, including: atomic absorption spectrometer, gas chromatograph, high performance liquid chromatograph, infrared, ultraviolet-visible, and magnetic resonance spectrometers. The Chemistry Department has also recently acquired research-quality ultraviolet-visible and Fourier transform infrared spectrometers.

The facilities and equipment are used by students throughout their studies at Mansfield in a variety of supervised laboratory experiments. These experiments and, in fact, the entire chemistry curriculum are designed to give the student a sound and broad based background in the theory and practice of chemistry. The program is structured to meet the standards of the American Chemical Society and the needs of a small department. Close student-faculty interaction assures the student of access to and the attention of their faculty. Students and faculty often develop relationships that extend beyond the classroom, by interaction in social activities like picnics and field trips, to private conversations about research and career plans. Upon a visit to the Chemistry office in Grant Science Center, you may witness students and faculty engaged in discussions of all sorts. Students often have a cup of coffee in the department office to kill a few minutes between classes, or drop in at their professor's

office to chat. This close-knit, open spirit provides an optimal learning environment for students and faculty.

In addition to the traditional curriculum offerings, Mansfield also offers the opportunities for students to perform chemical research with a faculty member or to participate in a cooperative education program.

All of the faculty in the Chemistry Department at Mansfield hold the doctorate (Ph.D.) in chemistry. They represent a great diversity of interest in chemistry that covers the major areas of analytical, inorganic, organic (biochemistry), and physical chemistry. At Mansfield, teaching undergraduates is the highest priority within the institution and the department. In addition, the faculty also have research interests that students can be involved with during their studies. The faculty and their major teaching and general research interests appear below.

Dr. Arnold George, Chair. (Inorganic and General Chemistry)

Dr. Jack Sidler (Organic and Biochemistry)

Dr. Ramaswamy Gnanasekaran (Analytical Chemistry)

Dr. Scott A. Davis (Physical and Introductory Chemistry)

The goals of the Chemistry Department, and those of Mansfield University, are to offer a quality, liberal arts educational experience, combined with a concentration in a major academic discipline at an affordable cost. Mansfield is in a unique position to provide such an experience. Its small size, low student to faculty ratio, faculty committed both to teaching excellence and a liberal arts curriculum, assure a quality educational environment. Its affiliation with the state assures accredited and affordable education. At Mansfield the best of both combine for a thriving academic community of faculty and students as fellow learners.

Mansfield University

Mansfield University is situated on a hill overlooking the borough of Mansfield at the intersection of U.S. Routes 6 and 15, 30 minutes from Elmira, NY, and Corning, NY, and 1 hour from Williamsport, PA. The surrounding terrain and view is that of Pennsylvania's Northern Tier, including its woodlands and farms, soaring hills and fertile valleys. The campus reflects the history and future of Mansfield University. Amongst the tall trees and green lawns, walkways and benches, are both traditional and modern buildings providing locations for study, relaxation and thought. The facilities include the planetarium, three auditoriums, the computer center, the library with over one million volumes and athletic facilities including an Olympic-sized pool.

Mansfield University traces its history to 1857 when the Mansfield Classical Secondary School opened with 105 students. In 1862, Mansfield became a State Normal School and in 1927 was the first institution in Pennsylvania to be designated a State Teachers College. The school assumed the name Mansfield State College in 1960. In 1983 it became Mansfield University, one of the 14 fully accredited universities in the Pennsylvania State System of Higher Education. Now, over 130 years after its founding days, Mansfield is a four-year, co-educational, fully accredited institution, boasting an enrollment of over 2600 undergraduate in 50 undergraduate and state certification programs. At the center of all of these programs is a commitment to a quality liberal arts education. Mansfield University insures this educational goal with a broad based General Education Program of required and elective courses in Humanities, Languages, Natural Sciences, Mathematics and Social Sciences for all students.

Opportunities and Activities

A quality undergraduate degree is more than an accumulation of courses in a major. The courses need to be taught by faculty that care about the individual needs and talents of each student. At Mansfield, courses within and outside of your major are taught by such faculty. The courses for the major concentration need to provide a sound basis for the student's future possibilities. The list of courses required for the different chemistry degrees is given in the next section. Additional courses required of all Mansfield students ensure a well-rounded liberal arts education.

However, a quality degree program also provides opportunities outside the classroom for its students. In the chemistry department, several such opportunities and activities exist for students to utilize their undergraduate experiences in non-traditional ways. All of these expand, increase and enhance the educational experience of the student. Students should look into and consider participating in such activities during their undergraduate experience.

Employment/Cooperative Education

As a chemistry major, you have skills that employers are seeking before you graduate. As such, there are numerous opportunities for summer employment in academic or industrial laboratories. In academic labs, this experience involves students in ongoing state-of-the-art research. In industrial labs, this involves the student in different (often new to the student) experimental techniques. Such experiences broaden the students knowledge base and increase their confidence level. Announcements for these employment opportunities regularly arrive at Mansfield.

Several local industries have made arrangements with Mansfield for students to continue their employment into the academic year. As a result,

these students receive course credit for their experience, through a cooperative education agreement. This enables the student to earn and learn at the same time. Such opportunities expose the student to valuable career and practical laboratory experiences during their undergraduate education.

Research

In addition to the experience in practical and routine laboratory practices gained by employment, opportunities exist for the student as researcher. These research experiences are available with faculty members involved in research projects of their own. In these projects, the student becomes the primary researcher, working first hand on a project and its analysis. The student-faculty relationship becomes more collegial in nature, as they work together toward the common goal of understanding a research problem. This engages the student actively in performing research in chemistry and provides a glimpse of basic research in action. All of these co-curricular activities enhance the opportunities available to the student upon graduation from Mansfield University.

Chemistry Club

The Chemistry Club is a non-academic, social organization to which most chemistry majors belong. The Chem Club offers an opportunity for students and faculty to interact in an informal setting. Activities include picnics and pizza parties, hosting speakers and school tours, field trips, and performing demonstrations for National Chemistry Day. Chemistry Club members are eligible to become student affiliate members of the American Chemical Society (ACS), the professional society for chemists in the United States. As an ACS affiliate, the student is provided with the advantages of a professional society, including career opportunities, employment aids, current scientific information, student newsletter and more.

LIST OF PROGRAMS

- Bachelor of Science (B.S.) in Liberal Arts
- Bachelor of Science in Education (B.S.E.) in Secondary Education
- Associate of Arts in Liberal Studies (A.A.) with Chemistry Emphasis
- Bachelor of Arts (B.A. in Physics/Chemical Pre-Engineering)
- Minor in Chemistry (Not a degree program)

BACHELOR OF SCIENCE (B.S.) IN LIBERAL ARTS

The B.S. program prepares the student for a career in industry as a professional chemist. Other career options include: biochemist, chemical processor, nutritionist, science editor, environmentalist, food and sanitary inspector, hospital administrator, laboratory assistant, medical illustrator, medical librarian, science librarian, medical technologist, public health educator, technical writer, epidemiologist, toxicologist, pharmacologist, chemical sales person, public health employee, science/research firm administrator, food scientist, etc. The B.S. degree also can prepare the student for graduate work in chemistry, chemical engineering, dentistry, pharmacy, medicine, optometry, physiology, college teaching, etc.

COURSE REQUIREMENTS

Chemistry

General (111,112)
Organic (211,212)
Quantitative Analysis (311)
Physical (321,322)
Instrumental Analysis (332)
Seminar (410)
Qualitative Organic (420)
Advanced Inorganic (431)

Optional (at least two)

Biochemistry (341)
Radiochemistry (352)
Advanced Organic (421)
Structural (432)

Mathematics

Calculus I,II,III (140,141,240)
plus 1 Math elective

Physics

General (188,211)

Occasionally, other equal or higher level courses may be substituted for those specified under the mathematics and physics requirements. Before substitutes can be made the student in consultation with his or her advisor must submit a written justification for departmental consideration and approval.

It is expected that students will devote 12 semester hours of their elective credits to math and science courses other than those listed above.

Typical B.S. Chemistry course sequences appear on these two pages. Due to cycling of upper division courses, two different sequences appear, dependent upon the year that the student begins matriculation.

Student begins in odd year (e.g. 1989-90)

FIRST YEAR

1st Semester			2nd Semester		
Course #	Name	SH	Course #	Name	SH
CHM 111	General	4	CHM 112	General	4
*MA 130	Alg & Trig	3	MA 140	Calc I	3
COM 101	Speech	3	--	Electives	9
ENG 112	Composition	3	--	Phys Ed	1
HPE 100	Health	2			17
--	Elective	3			
		18			

SECOND YEAR

CHM 211	Organic	4	CHM 212	Organic	4
CHM 311	Quant. Analysis	4	MA 240	Calc III	3
MA 141	Calc. II	3	PHY 211	General	4
PHY 188	General	4	--	Electives	6
--	Elective	3	--	Phys Ed.	1
		18			18

THIRD YEAR

CHM 420	Qual. Org.	4	CHM 431	Adv. Inorg	4
ENG 313	Comp / Lit.	3	CHM 410	Seminar	1
--	Electives	6	CHM --	Elective	3
--	Phy. Ed	1	--	Elective	9
CHM --	Elective	3			17
		17			

FOURTH YEAR

CHM 321	Physical	4	CHM 322	Physical	4
CHM	Elective	3	CHM 332	Instrumental	4
--	Electives	9	CHM 410	Seminar	1
		16	--	Electives	6
					15

*Most students are advised to begin their mathematics sequence with MA 130, Algebra and Trigonometry.

B.S. Chemistry

Student begins in even year (e.g. 1990-91)

FIRST YEAR

1st Semester			2nd Semester		
Course #	Name	SH	Course #	Name	SH
CHM 111	General	4	CHM 112	General	4
*MA 130	Alg & Trig	3	MA 140	Calc I	3
COM 101	Speech	3	--	Electives	9
ENG 112	Composition	3	--	Phys Ed	1
HPE 100	Health	2			17
--	Elective	3			
		18			

SECOND YEAR

CHM 211	Organic	4	CHM 212	Organic	4
CHM 311	Quant. Analysis	4	MA 240	Calc III	3
MA 141	Calc. II	3	PHY 211	General	4
PHY 188	General	4	--	Electives	6
--	Elective	3	--	Phys Ed.	1
		18			18

THIRD YEAR

CHM 321	Physical	4	CHM 322	Physical	4
ENG 313	Comp / Lit.	3	CHM 332	Instrumental	4
CHM --	Elective	3	CHM 410	Seminar	1
--	Electives	6	--	Electives	6
--	Phys Ed	1			15
		17			

FOURTH YEAR

CHM 420	Qual. Org.	3	CHM 431	Adv. Inorganic	4
CHM --	Elective	3	CHM 410	Seminar	1
--	Electives	9	CHM --	Elective	3
		15	-	Electives	9
					17

*Most students are advised to begin their mathematic sequence with MA 130, Algebra and Trigonometry.

BACHELOR OF SCIENCE IN EDUCATION (B.S.E.) IN SECONDARY EDUCATION

The B.S.E. program leads to certification as a qualified teacher of chemistry in secondary schools. In addition, the student receives a sufficiently extensive background to allow him/her to continue on to graduate school for further studies in chemistry. A student who completes the program will graduate with a provisional certificate to teach in the Commonwealth of Pennsylvania.

The current demand for high school teachers of chemistry, both nationwide and in Pennsylvania, is high and the future looks bright for qualified people. In addition, the B.S.E. is the traditional entry level degree for school administrative positions such as school counselors, principals, superintendents, educational specialists, etc.

COURSE REQUIREMENTS

Chemistry

General (111,112)
Organic (211,212)
Quantitative Analysis (311)
Physical (321)
Instrumental Analysis (332)
Seminar (410)

Physics

General (188,211)

Optional (at least two)

Physical (322)
Biochemistry (341)
Radiochemistry (352)
Qualitative Organic (420)
Advanced Organic (421)
Advanced Inorganic (431)
Structural (432)

Mathematics

Calculus I (140)
AND
Calculus II
OR
Statistics (105)
AND Computer Prog. (107)

Education

Introduction (101)
Secondary Exper. (202)
Secondary Meth. (300)
Eval. Techniques (301)
Instruct. Tech. (302)
Reading Practices (310)
Hist. & Phil. Educ. (401)
Student Teaching (400)
Contemp. Issues (402)

Psychology

Educational (230)
Adolescent (321)

13.1396
CHEMISTRY B.S.E.
(eff. F-87)

NAME _____

SOC. SEC. NO.

DATE ADMITTED _____

CHEMISTRY EDUCATION MAJOR 31SH

GRADE OR DATE

Chm 112 Gen'l Chem II	4		
Chm 211 Organic Chem I	4		
Chm 212 Organic Chem II	4		
Chm 311 Quantitative Anly	4		
Chm 321 Physical Chem I	4		
Chm 332 Instrumental Anly	3		
Chm 410 Seminar	1		
Chm 410 Seminar	1		

CHEMISTRY ELECTIVES - 6-8 SH

(322, 341, 352, 420, 421, 431, 432)

PROFESSIONAL EDUCATION 32 SH

Ed 101 Intro to Education	1			
Ed 202 Sec Ed-Pre-Prof Exp	1			
Ed/Psy 230 Educ Psych	3			
Ed 300 Secondary Sch Mtds	3			
Ed 301 Evaluative Tech	2			
Ed 302 Instructional Tech	2			
Ed 310 Basic Rdg Practices	3			
Ed 401 Hist & Phil Educ	3			
Ed 402 Contemp Issues	2			
Ed 400 Student Teaching	12			

FREE ELECTIVES

SH

Approved Courses - 9 SH

[illegible]

Adv. Standing

(min. 6 SH one lang./max. 12 SH)

S.H. Credited _____ Required 128 SH

GROUP 3 NATURAL SCIENCE (min. 9 SH/max. 18 SH)

Approved Courses - 9 SH

[illegible]**GROUP 4 MATHEMATICS** (min. 6 SH/max. 12 SH)

Wa 140 Anly Geom&Calc I	3			
Wa 141 OR 105 & 107	3			

GROUP 5 SOCIAL SCIENCE (min. 9 SH/max. 18 SH)

Approved Courses - 9 SH (min. 6 SH req.)

Psy 101 Intro Gen'l Psych	3		
	3		

GENERAL EDUCATION ELECTIVES (min. 9 SH/max. 12 SH)

Psy 321 Adolescent Psych	3			

SPECIAL RULES:

- 1) 090 courses do not count toward graduation.
- 2) Max. 6 SH in major allowed in G.E. Dist. area.
- 3) Max. 2 courses with same prefix in GROUPS.
- 4) Max. 12 SH with same prefix in G.E. Dist. area.
- 5) One non-major professional elective allowed.

Typical B.S.E. Chemistry course sequences appear on these two pages. Due to cycling of upper division courses, two different sequences appear, dependent upon the year that the student begins matriculation.

Student begins the odd year (e.g. 1989-90)

FIRST YEAR

1st Semester			2nd Semester		
Course #	Name	SH	Course #	Name	SH
CHM 111	General	4	CHM 112	General	4
*MA 130	Alg & Trig	3	MA 140	Calc I	3
COM 101	Speech	3	Eng 112	Composition	3
ED 101	Introduction	1	Psy 101	Intro Psy	1
HPE 100	Health	2	---	Phys Ed	1
HIS 201	American Hist	3	---	Elective	3
		16			17

SECOND YEAR

CHM 211	Organic	4	CHM 212	Organic	4
MA 141	Calc II OR		PHY 211	General	4
105	Statistics	3	ED 230	Ed. Psych	3
PHY 188	General	4	CHM 332	Instrumental	4
ED 202	Pre-Prof. Exp.	1	**MA 107	Comp. Prog.	3
CHM 311	Quant. Analysis	4			18
		16			

THIRD YEAR

CHM ---	Elective	4	CHM ---	Elective	4
PSY 321	Adolescent	3	ED 300	Sec. Methods	3
ED 301	Eval. Tech.	2	ED 302	Inst. Tech.	2
ED 401	Hist / Phil Ed.	3	ED 310	Reading Pract.	3
---	Elective	3	CHM 410	Seminar	1
		15	---	Elective	3
					16

FOURTH YEAR

CHM 321	Physical	4	ED 400	Student Teaching	12
ENG 313	Composition	3			
ED 402	Contemp. Issues	2			
---	Elective	6			
		15			12

*Most students are advised to begin their mathematics sequence with MA 130, Algebra and Trigonometry

**Student may take Calc I and Calc II, or Calc I, Statistics and Computer Programing

B.S.E. Chemistry

Student begins odd year (e.g. 1990-91)

FIRST YEAR

1st Semester			2nd Semester		
Course #	Name	SH	Course #	Name	SH
CHM 111	General	4	CHM 112	General	4
*MA 130	Alg & Trig	3	MA 140	Calc I	3
COM 101	Speech	3	Eng 112	Composition	3
ED 101	Introduction	1	Psy 101	Intro Psy	1
HPE 100	Health	2	--	Phys Ed	1
HIS 201	American Hist	3	--	Elective	3
		<u>16</u>			<u>17</u>

SECOND YEAR

CHM 211	Organic	4	CHM 212	Organic	4
MA 141	Calc II OR		PHY 211	General	4
105	Statistics	3	ED 230	Ed. Psych	3
PHY 188	General	4	CHM --	Elective	4
ED 202	Pre-Prof. Exp.	1	**MA 107	Comp. Prog.	3
--	Electives	6			<u>18</u>
		<u>18</u>			

THIRD YEAR

CHM 321	Physical	4	CHM 322	Physical	4
PSY 321	Adolescent	3	CHM 332	Instrumental	4
ED 301	Eval. Tech.	2	CHM 410	Seminar	1
ED 401	Hist / Phil Ed.	3	ED 310	Reading Pract.	3
--	Elective	3	ED 300	Sec. Methods	3
		<u>15</u>	ED 302	Inst. Tech.	2
					<u>17</u>

FOURTH YEAR

CHM --	Elective	4	ED 400	Student	
ENG 313	Composition	3		Teaching	12
ED 402	Contemp. Issues	2			
--	Elective	6			
		<u>15</u>			<u>12</u>

* Most students are advised to begin their mathematics sequence with MA 130, Algebra and Trigonometry.

**Student may take Calc I and Calc II, or Calc I, Statistics and Computer Programing.

BACHELOR OF ARTS (B.A. IN PHYSICS/PRE-ENGINEERING CHEMICAL)

The Physics Department in cooperation with the Chemistry Department at Mansfield University offers a five-year cooperative chemical engineering program with Penn State University, University of Rochester, University of Pittsburgh and Georgia Institute of Technology. The first three years are spent at Mansfield, the final two years at one of the cooperative universities. Students are able to capitalize on the special advantages Mansfield University offers. These include close personal attention by the faculty, a broad background in liberal arts and sciences at relatively low cost, assured acceptance for qualified students into superior engineering programs at a variety of universities, and the opportunity to study in a beautiful rural setting. At program completion students will receive a B.A. in physics from Mansfield and the chemical engineering degree from the cooperative university.

The need for chemical engineers is evident from a quick scan of the problems facing society: dwindling fossil fuels, possible risks of nuclear power, a need for alternative energy sources, scarcity of mass transit systems, environmental problems, the need for new products, etc.

COURSE REQUIREMENTS

Chemistry

General (111,112)

Organic (211,212)

Physics

General I,II,III (188,211,212)

Mechanics (312)

Exper. Physics I,II (315,316)

PLUS five electives at
300/400 level

Mathematics

Calculus I,II,III,IV

(140,141,240,241)

Scientific Programming (160)

Differential Equations (311)

PLUS one elective

ASSOCIATE OF ARTS IN LIBERAL STUDIES (A.A.) WITH EMPHASIS IN CHEMISTRY

This is a two year program. The courses required for the Chemistry emphasis have been selected to help prepare the A.A. candidate for a challenging career as a chemical technician. While the technician's job is often routine, the work is important. Usually the chemical technician is an integral part of a larger team doing research to gain new information or improve products. The technician is a specialist who is expected to be able to apply his knowledge and skills to a variety of tasks that might involve trouble shooting, the identification of substances, the collection of data, quality control, and the testing of materials.

Advisement for the Associate degree will be conducted by the Advising Center for the first year and by the major department for the second year. However, the Chemistry Department recommends that A.A. candidates seek advisement by the Chemistry Department throughout their program.

All courses for General Education will be selected from the approved list of General Education courses, and all A. A. candidates will be required to fulfill the all-college requirements at the 090 level.

COURSE REQUIREMENTS

Chemistry

General (111,112)
Organic (211,212)
Quantitative Analysis (311)

Mathematics

Algebra and Trig. (130)

Optional (1 course in 3 areas)

History
Literature
Philosophy
Languages

General Education

English 112
Speech 101
Health/Phys. Educ.
Fine Arts (Art, Music or
Theater)

Optional (1 course in 3 areas)

Economics
Geography
Political Science
Psychology
Sociology/Anthropology

MINOR IN CHEMISTRY

The Chemistry Department offers a minor to all interested persons who fulfill the basic requirements of the program. The minor, while not a degree program, is intended to permit students to develop their interest in chemistry and thereby broaden their background as they acquire marketable skills.

A minor in Chemistry consists of 22 to 24 credit hours in chemistry, including those listed below.

Chemistry

General (111,112)

Organic (211,212)

Optional (6 to 8 hours)

Any 300/400 level course

EXCEPT 410,490,497

Course Descriptions

- Chem 111 General Chemistry I (4) Designed for science majors, this course is a study of the fundamental principles of chemistry from the standpoint of stoichiometry, gases, states of matter, solutions and equilibrium theory. Laboratory sessions stress chemical principles discussed in the lecture. 3 hrs lecture. 3 hrs lab.
- Chem 112 General Chemistry (4) A continuation of CHM 111, kinetics, thermodynamics, oxidation-reduction, atomic and molecular structure, bonding and periodic relationships are studied. The laboratory work is an introduction to inorganic qualitative analysis and includes experiments designed to exemplify chemical principles. Laboratory sessions include one hour of lecture on theory and techniques of laboratory operations. Prerequisite: CHM 111. 3 hrs lecture. 3 hrs lab.
- Chem 211 Organic Chemistry I (4) Fundamentals of organic chemistry are presented. Modern theory, reaction mechanisms and stereochemistry are included along with nomenclature, preparations, reactions and properties of organic compounds. The laboratory stresses synthesis, chemical and physical properties and an introduction to instrumental techniques. The laboratory period includes one hour of lecture on theory and techniques of laboratory operations. Prerequisite: CHM 112. 3 hrs lecture. 4 hrs lab.
- Chem 212 Organic Chemistry II (4) A continuation of CHM 211. The laboratory period includes one hour of lecture on theory and techniques of laboratory operations. Prerequisite: CHM 211. 3 hrs lecture. 4 hrs lab.
- Chem 311 Quantitative Analysis (4) An introductory course in analytical chemistry emphasizing classical titrimetric and gravimetric methods and related theories. Prerequisite: CHM 112. 3 hrs lecture. 4 hrs lab.
- Chem 321 Physical Chemistry I (4) A study of the fundamental principles of thermodynamics of gases and non-electrolytes. Topics include kinetic theory, gases, thermodynamic and nonelectrolyte solution. Prerequisites: CHM 112 and 311, MA 240, PHY 188 and 211. 3 hrs lecture. 4 hrs lab.
- Chem 322 Physical Chemistry II (4) A continuation of CHM 321. Topics include: thermodynamics of electrolytes, atomic and molecular structure and chemical kinetics. Prerequisite: CHM 321. 3 hrs lecture. 4 hrs lab.
- Chem 332 Instrumental analysis (3) Principles and applications of instrumental methods in chemical and structural analysis. Studies include electroanalytical, spectrophotometric and chromatographic techniques. Prerequisite: CHM 311. 2 hrs lecture. 3 hrs lab.

- Chem 341 Biochemistry (4) A study of carbohydrates, lipids, proteins, enzymes, nucleic acids, vitamins and hormones in terms of structure, function and synthesis in living systems. The laboratory includes the isolation, identification and chemical behavior of biochemically important molecules. Prerequisite: CHM 212 or consent of instructor. 3 hrs lecture. 3 hrs lab.
- Chem 410 Seminar (1) Reports emphasizing chemical literature searches and/or current research. Prerequisite: upper division chemistry majors.
- Chem 420 Qualitative Organic Chemistry (3) The identification of organic compounds by various classical and instrumental techniques. Prerequisite: CHM 212. 2 hrs lecture. 4 hrs lab.
- Chem 421 Advanced Organic Chemistry (3) An advanced lecture course designed to deepen and expand knowledge in the field. Topics such as reactions, mechanisms, reactive intermediates, photochemistry, natural products and spectroscopy may be stressed. Prerequisite: CHM 212. 3 hrs lecture.
- Chem 431 Advanced Inorganic Chemistry (4) A presentation of atomic structure and periodic properties. In addition to other topics, balance bond, molecular orbital, crystal field and ligand field theories are treated in detail. Laboratory sessions include one hour of lecture on theory and techniques in the preparation of representative compounds. 3 lecture. 4 hrs lab.
- Chem 432 Structural Chemistry (3) An advanced lecture course designed to study the structure of molecules. The shape of molecules and the nature of the bonds between their atoms will be used to predict molecular energy levels and vibrational modes, along with the associated spectroscopy. Prerequisite: CHM 212. 3 hrs lecture.

